Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 80

CHAPLEAU AREA

(NTS 41O/NW)

Districts of Algoma and Sudbury

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MINISTRY OF NORTHERN DEVELOPMENT
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by
M.A. Roed and D. R. Hallett

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CONTENTS

		Page
1.0	Introduction	1
	1.1 Terrain Mapping Program	2
	1.2 Previous Work	2
2.0	Geologic Setting	3
	2.1 Bedrock Geology	3
	2.2 Quaternary Geology	3
	2.3 Physiography	5
3.0	Engineering Terrain Units	5
	3.1 Bedrock	5
	3.2 Moraine	7
	3.3 Glaciofluvial	11
	3.4 Eolian	13
	3.5 Organic	13
	3.6 Alluvial	14
4.0	Example of Derived Map: Engineering Capability	14
	4.1 Types of Derived Maps	14
	4.2 Engineering Capability Map	15
	4.2.1 Aggregate Extraction	16
	4.2.2 Transportation Route Alignment	16
	4.2.3 Groundwater Potential	17
	4.2.4 Solid Waste Disposal	17
	4.2.5 Septic System Installation	18
	4.2.6 Hazard Land	18
5.0	References	19

TABLE

1 – Summary of terrain unit characteristics and engineering significance 8

FIGURE

1 – Diagrammatic sketch showing typical terrain types and their representative letter symbols 6

MAPS
(accompanying report)

Map 5014 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Chapleau (NTS 41O/NW). Scale 1:100 000.

Map 5018 (coloured) – Northern Ontario Engineering Geology Terrain Study, Engineering Capability Map, Chapleau (NTS 41O/NW). Scale 1:100 000.

Northern Ontario

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CHAPLEAU AREA

(NTS 41O/NW)

Districts of Algoma and Sudbury

by

M. A. Roed[1] and D. R. Hallett[2]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the Chapleau area, Districts of Algoma and Sudbury. It forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The area, which covers NTS block 41O/NW, lies between Latitudes 47°30'N and 48°00'N and Longitudes 83°00'W and 84°00'W. The principal economic activity in this sparsely populated area is forestry, while tourism and mineral exploration are very important seasonal activities. The town of Chapleau is the centre of the forestry industry for the area.

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1.1 TERRAIN MAPPING PROGRAM:

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5014, accompanying this report). The Engineering Capability Map is a derived map which illustrates the suitability of the terrain units in the Chapleau area for the following uses: aggregate extraction, transportation route alignment, groundwater supply, solid waste disposal, and septic system installation.

Interpretation of black and white aerial photographs, at a scale of approximately 1:50 000, was the primary method of obtaining this terrain information. The interpretation includes information from relevant published literature. The main roads in the area were traversed during the summer of 1977 to provide spot checks of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of the maps is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard and Roed, in preparation), a companion publication to this series of maps and reports.

1.2 PREVIOUS WORK:

There have been no previous engineering geology studies undertaken within the area. The surficial deposits have been mapped on a reconnaissance basis by Boissonneau (1965, 1968). Other relevant surficial geology studies can be found in Prest (1969, 1970), Prest *et al.* (1967), Thurston *et al.* (1977), the Ontario Land Inventory (1976), Dean (1956), and Skinner (1969). Regional bedrock geology has been compiled by Thurston *et al.* (1976) and discussed by Thurston *et al.* (1977). Mineral potential has been summarized by Springer (1977).

2.0 GEOLOGIC SETTING:

A discontinuous mantle of Quaternary surficial deposits overlies crystalline bedrock of Precambrian age in the Chapleau area. The terrain is dominated by glaciofluvial outwash plains, eskers, kames, ground moraine, and hummocky moraine. Eolian deposits are commonly found overlying the outwash plains. Rocky uplands and organic terrain are also important terrain units in this area. The most striking geologic feature is the prominent butte-like igneous rock complex referred to as Lackner Hill and located in the eastern part of the area.

2.1 BEDROCK GEOLOGY:

Bedrock in the Chapleau map-area consists primarily of Precambrian migmatitic, felsic intrusive, and metamorphic rocks belonging to the Superior Province of the Canadian Shield. A belt consisting of Kapaskasing Structural Zone metamorphic rocks and rocks of the Shawmere Anorthosite Complex underlie the northeastern quarter of the area. Carbonatite-alkalic complexes (e.g. Lackner Hill) are also common. Northerly trending diabase dikes occur and several prominent faults have been mapped (Thurston *et al.* 1976).

Most of the Chapleau map-area has least or unknown mineral potential. The carbonatite-alkalic complexes at Lackner Hill and Nemegosenda Lake have high potential for rare earth elements and uranium-thorium (Springer 1977).

2.2 QUATERNARY GEOLOGY:

Northern Ontario was glaciated by continental ice sheets at least four times during the Pleistocene. However, only the deposits of the last glaciation, the Laurentide of Wisconsinan age, are preserved in the Chapleau area.

The Keewatin lobe of the Laurentide ice sheet advanced from the northeast at the beginning of the Wisconsinan (approximately 100 000 years ago) and eventually extended as far south as Minnesota (Prest 1970).

By late Wisconsinan time (approximately 11 000 years ago), the ice had receded to the Chapleau area and deposited a variety of surficial materials. The glacier may have disappeared completely from the area at this time and then readvanced to the position presently marked by the Sultan Scarp (Roed 1979a), or it may have formed the Sultan Scarp during a halt in its recession. In either event, the Sultan Scarp in the southeast part of the map-area is recognized as the only major stillstand of this ice sheet in the area. The morainal scarp is bounded on the south by an extensive glaciofluvial outwash plain which represents a substantial outflow of meltwater from a wide front. Much of this meltwater escaped to the southwest along the valley presently occupied by the Cow River and further west by the Montreal River, and to the south along the Wenebegon River (Roed and Hallett 1979). During the final phase of this event, drainage in one or more of these meltwater channels must have been blocked, resulting in ponding for a brief time, since raised beaches occur on the surface of the outwash plain south of the Sultan Scarp.

Other important glacial deposits that occur throughout the map-area include till, deposited directly by the ice, and esker and kame complexes deposited by meltwater in contact with the ice.

Deglaciation of the northern and eastern parts of the map-area occurred by mass disintegration of the ice. Evidence of this is provided by the occurrence of vast tracts of hummocky moraine and pitted outwash plain. Local ponding occurred, but most of the outwash sand deposits exhibit sedimentary structures that indicate slow deposition in slow-moving water. These deposits could generally be interpreted as lacustrine in origin, as in the case of Lake Sultan, described by Boissonneau (1968).

By approximately 9 000 years ago, the area was probably ice-free, and for a time much of the landscape was affected by eolian activity. Modern streams became established, alluvium was deposited, and organic deposits accumulated in wet depressions. These non-glacial deposits, together with the various glacial deposits, complete the spectrum of Quaternary unconsolidated materials that form a discontinuous mantle over the bedrock in the map-area.

2.3 PHYSIOGRAPHY:

Most of the terrain in the Chapleau area is of low to moderate relief, with rock knobs and moraine forming the uplands and glaciofluvial deposits underlying the lowlands. Elevations range from less than 335 m near Nemegosenda Lake to a maximum of at least 579 m near the Pemache River and on Lackner Hill. Windermere, Como, Borden and Nemegosenda Lakes are large lakes in the northern part of the area.

3.0 ENGINEERING TERRAIN UNITS:

Engineering terrain units are composed of a combination of various materials (unconsolidated and/or bedrock) which form recognizeable landforms with certain engineering characteristics. Major terrain unit groups, and the engineering significance of each, are discussed in detail. These include bedrock terrain (RN), moraine (MG, MH), glaciofluvial outwash (GO), eskers (GE), and kames (GK), and organic terrain (OT). Less significant terrain units include alluvium (AP) and eolian deposits (ED). A diagrammatic sketch of typical terrain settings is given in Figure 1. Table 1 summarizes the characteristics and engineering significance of all major terrain units.

3.1 BEDROCK:

Examples:

$$\frac{\text{RN(tMG)}}{\text{Mju-D}} \qquad \frac{\text{RN(tMG)}}{\text{Hj-D}}$$

Bedrock terrain (RN), which occurs in the northwestern corner of the Chapleau area, constitutes ground that is underlain by bedrock, either at surface or within 1 to 2 m of the surface. There is very little overburden in this unit, although patches of ground moraine (MG) till occur throughout and deposits of peat in organic terrain (OT) occupy poorly drained depressions. Most of the rock terrain is of moderate relief (M) and is rugged (j) to knobby (n) in character. A small amount of high relief rock terrain occurs in the southwest corner of the area. Drainage is generally good except in the organic depressions. Small eskers, crevasse

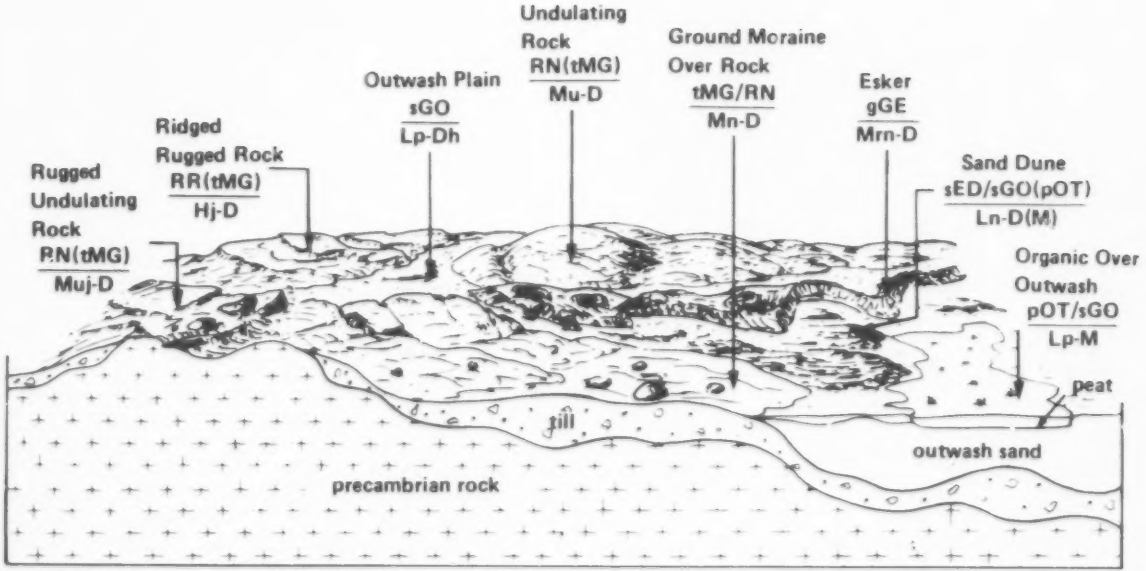

FIGURE 1 – DIAGRAMMATIC SKETCH SHOWING TYPICAL TERRAIN TYPES AND THEIR REPRESENTATIVE LETTER SYMBOLS.

fillings and drumlins can be found in this unit, together with a small number of scarps and steep sided gullies.

The principal engineering significance of bedrock terrain is that it is difficult and expensive to excavate. Blasting is required for all subsurface excavations. Extensive cut-and-fill operations are required in rugged terrain for transportation route construction, in order to eliminate extreme horizontal and vertical alignments. Many small sand, gravel and till deposits scattered throughout the terrain provide adequate material for minor access road construction. However, for major transportation routes, aggregate is often from considerable distances at high cost.

Bedrock terrain provides excellent foundation conditions in areas that are unaffected by faults and where fracture or joint density is low. The unit also possesses considerable potential for aggregate obtained in rock quarry operations.

Groundwater potential is generally poor in bedrock terrain, but is usually sufficient for scattered domestic demand. Considerable groundwater production can be expected in fractured localities or in fault zones. Bedrock is unsuitable for waste disposal except where a thick layer (at least 1.5 m) of soil material is present.

3.2 MORAINE:

Examples:

$$\frac{\text{tMG(RN)}}{\text{Mu-D}} \qquad \frac{\text{tMG(RN)}}{\text{Huj-D}} \qquad \frac{\text{tMG}}{\text{Ldu-D}} \qquad \frac{\text{tsMG(RN)(pOT)}}{\text{Mnj-D(D)(W)}}$$

$$\frac{\text{tMG(RN)}}{\text{Lj-D}} \qquad \frac{\text{tsMG(pOT)}}{\text{Lup-D(M)}} \qquad \frac{\text{tsMG}}{\text{Mu-D}} \qquad \frac{\text{tsMH(pOT)}}{\text{Lnp-D(W)}} \qquad \frac{\text{tsMH(RN)}}{\text{Ln-D}}$$

Morainal landforms in this map-area are either ground moraine (MG) or hummocky moraine (MH). Ground moraine (MG) consisting of sandy till (ts) occurs extensively throughout the north-central and southwestern parts of the map-area as a major terrain unit or as a subordinate unit in rock terrain. The till varies from 1 m to more than

TABLE 1 SUMMARY OF TERRAIN UNIT CHARACTERISTICS AND ENGINEERING SIGNIFICANCE.

Terrain Unit	Principal Materials	Topography / Drainage	Workability as Construction Material / Permeability	Shearing Strength / Bearing Value	Compaction / Compressibility
Rock Terrain (R)	rock	irregular / dry	not applicable / medium (fracture)	excellent / excellent	not applicable / not applicable
Hummocky Moraine (MH)	till, sand / boulders	hummocky / dry	good / medium	good / good	good / low
Ground Moraine (MG)	till, sand / boulders	knobby / dry	good / medium	good / good	good / low
Eskers (GE) Kame (GK)	sand / gravel	kettled & ridged / dry	excellent / high	excellent / excellent	excellent / low
Outwash (GO) Delta (GD)	sand, / gravel	hummocky-planar / dry	excellent / high	excellent / excellent	excellent / low
Glaciolacustrine Plain (LP)	clay, silt / fine sand	planar / dry	poor / low	fair / fair	poor / high
Glaciolacustrine Beach (LB)	sand	planar / dry	good / high	good / good	good / low
Alluvium (AP)	sand, silt / clay	channelled / mixed	fair / medium	good / poor	fair / medium
Eolian (ED)	sand	ridged, hummocky / dry	fair / high	good / good	good / low
Colluvium Soil (CW,CS)	clay, silt	sloped / mixed	poor / low	poor / poor	poor / high
Colluvium Talus (CT)	rubble	sloped / dry	poor / high	good / poor	poor / low
Organic (OT)	peat	planar / wet	poor / medium	poor / poor	poor / high

Notes:
1. The rating above or below the bar refers to the characteristic or use above or below the bar, respectively, in the column heading.
2. Permeability, compressibility, and frost susceptibility are rated as low, medium, or high; all other characteristics and uses are rated as poor, fair, good, or excellent.

Slope Stability / Frost Susceptibility	Aggregate Supply / Foundations	Highway Subgrade / Route Location	Hydro Easements / Pipeline Routes	Septic Tank Suitability / Solid Waste Landfill	Domestic Groundwater Potential / Large Groundwater Supplies
good (some talus) / not applicable	not applicable / excellent	poor / fair	fair / poor	poor / poor	good / poor
good / low	fair / good	good / good	good / good	excellent / excellent	excellent / good
good / low	fair / good	good / good	fair / fair	excellent / good	good / fair
excellent / low	excellent / excellent	excellent / excellent	good / good	poor / poor	excellent / excellent
excellent / low	excellent / excellent	excellent / excellent	excellent / excellent	poor / poor	excellent / excellent
poor / high	poor / fair	poor / good	good / good	fair / fair	fair / poor
excellent / low	good / good	good / good	good / good	poor / poor	good / poor
fair / medium	poor / poor	poor / poor	poor / poor	poor / poor	good / fair
good / low	poor / good	fair / good	good / good	fair / poor	good / fair
poor / high	poor / poor	poor / poor	poor / poor	poor / poor	fair / poor
good / low	poor / poor	poor / poor	poor / poor	poor / poor	poor / poor
poor / high	poor / poor	poor / poor	poor / poor	poor / poor	poor / poor

3. This is a generalized table intended for use in a number of reports; therefore, all terrain units dealt with in the table will not necessarily appear in each report.

7 m in thickness and commonly occupies rolling terrain of low (L) to moderate (M) relief with undulating (u) to slightly knobby (n) topographic character. The overall drainage is good (D). Southwesterly oriented drumlins are scattered throughout much of the unit. Low, rounded rocky hills (RN) and near-surface bedrock (/R) occur within the ground moraine, as does organic terrain (OT) in poorly drained depressions (W). Patches of glaciofluvial sand and gravel, eskers, kames, and hummocky moraine are also associated with the ground moraine. Geological contacts with these units are normally abrupt, except in the case of hummocky moraine and rock terrain where the contacts are often gradational.

Hummocky terrain (MH), also consisting of sandy till (ts), is most common in the northern and eastern parts of the map-area. The thickness of the till is much more variable than in ground moraine and may be as much as 30 m in some localities. Although till (t) is the principal material, stratified sand (s) and gravel (g), pockets of silt (m), and local concentrations of boulders (b) occur in places. Eskers and kames, rock knobs, and organic deposits are commonly associated with the hummocky moraine. Local relief is generally less than 20 m and the character of the surface is knobby (n), hilly, and sometimes kettled (k). Drainage is good except in closed depressions between knobs of till and along poorly developed seepage paths.

Large boulders, patches of poorly drained ground, and the possibility of near-surface bedrock are the principal engineering difficulties that may be encountered in the ground moraine unit. Generally, however, ground moraine poses few serious construction problems and is superior to bedrock terrain for route construction because grades are lower and the necessity for rock blasting is less probable. Pockets of granular material occur, and the till itself is amenable to beneficiation in some localities. Foundation conditions are generally good in till terrain. Groundwater potential is fair where the unit attains an adequate thickness. Where the till is at least 1.5 m thick, it is suitable for septic system installation.

The engineering significance of the hummocky moraine is substantial. The texture of the till makes the unit suitable for use in the large earth embankments required for roads and dams. Also, the chance of finding a sizeable source of granular material within hummocky moraine is good. Conventional construction techniques can be used throughout,

except where local relief is very irregular or where near-surface bedrock is encountered. The till in hummocky moraine is probably the best material in the map-area for attenuation of leachate from municipal land fills and septic drain tile fields. Groundwater potential, although inconsistent, is generally good; springs are common at the base of large morainal hills, especially in wet periods of the year.

3.3 GLACIOFLUVIAL:

Examples:

$$\frac{\text{sgGO(sED)(pOT)}}{\text{Lp-M}} \qquad \frac{\text{sgGO(pOT)}}{\text{Lpd-D(W)}} \qquad \frac{\text{sGO(sED)}}{\text{Lkp-D}}$$

$$\frac{\text{sgGO(tMG)}}{\text{Ln-D}} \qquad \frac{\text{sgGO}}{\text{Lp-D}} \qquad \frac{\text{sgGK(sED)}}{\text{Ln-D}} \qquad \frac{\text{sgGK}}{\text{Lkn-D}} \qquad \frac{\text{sgGE}}{\text{Ln-D}}$$

Large tracts of land in the Chapleau map-area are underlain by glaciofluvial outwash (GO) composed of sand (s) and gravel (g). Most outwash occurs in the form of undulating (u) to knobby (n) plains (p) of low relief (L) that are often dissected (d), kettled (k), and pitted. Often the upper 2 m of the deposit consists of fine- to coarse-grained sand. This is underlain by stratified pebble to cobble gravel which in places, is probably greater than 5 m thick. Interbedded sand and gravel layers may occur at depth. The maximum thickness of this outwash unit may be in the order of 40 m; this thickness estimate is based on the extent of the unit and the fact that rock terrain with relief in this range has been completely covered. Associated subordinate units include eolian sand (sED) and organic peat deposits (pOT) in wet depressions (W). The overall drainage is good (D). The most extensive outwash deposits occur to the east of Chapleau and in the southwest quarter of the map-area. Other outwash plains and terraces (t) along stream valleys are not as thick or extensive; rock knobs (RN) and organic terrain (OT) are subordinate landforms in these areas.

Large eskers are numerous in the northern and eastern portions of the area. The eskers occur as southward-trending continuous or discontinuous, sinuous, hummocky to rolling ridges of sand and gravel flanked by gently rolling outwash plains. Local relief on an esker is usually in the

order of 10 to 15 m; pits, kettle lakes, and isolated steep-sided knobs are common. Most of the eskers appear to be composed of sand and gravel in more or less equal proportions, but minor till inclusions and an upper mantle of till occur in places. In the esker core and also where the slopes are steep, gravel is usually the dominant constituent. Not all eskers are topographically prominent and, in some cases, these eskers may be buried extensions of those of the north.

Kames consist of irregular groupings of hills composed of sand, gravel, and till. These landforms differ from eskers in that they are not ridge-like and the internal composition is more heterogenous and variable. Otherwise, they are similar to eskers. Six kame complexes have been identified in the Chapleau area, with notable deposits (1) around Gallagher Lake in the east-central part of the area, (2) southeast of Nagasin Lake in the central part of the area, and (3) extending northeast through Triquet Township, Hoey Township, and Township 35 (Gilliland Township) in the western part of the area.

Eskers and kames are generally well drained, but do include minor patches of poorly drained organic terrain in local depressions. Buried eskers are well drained on the surface, but commonly have a high water table.

The engineering significance of glaciofluvial outwash, eskers, and kames is related to the excellent characteristics of the materials with respect to use in construction. Potential reserves of aggregate are extremely high in the northern portion of the area. Transportation routes, pipelines, and air strips are most easily constructed on the flat outwash plains. Eskers also have potential as transportation routes, although the sinuous form and some steep topography are disadvantages. Foundation and general construction conditions are excellent in glaciofluvial terrain. Groundwater potential is excellent where the deposits are thick and/or where the table is high. Glaciofluvial deposits are not suitable for waste disposal since the materials are permeable and the potential for pollution is high.

3.4 EOLIAN:

Examples:

$$\frac{\text{sED}}{\text{Lp-D}} \qquad \frac{\text{sED/sGO(pOT)}}{\text{Lp-D(M)}} \qquad \frac{\text{sED(pOT)}}{\text{Lnp-D(W)}}$$

Eolian deposits (ED) of fine sand (s) occur extensively throughout the southern and eastern portions of the map-area. The wind-blown deposits are derived mainly from glaciofluvial sand and occur as U-shaped dunes, small hills, and ridges. The deposits generally form a discontinuous blanket over other terrain units, most often outwash (GO), but also organic deposits. Most of the eolian deposits are in the form of blanket sand, with thicknesses of up to 1 m. Scattered dunes occur throughout the blanket sand and relief ranges from 2 to 5 m, which is also the approximate thickness of the dunes. Drainage varies from good to mixed (D-M), with a high water table in places (Dh). Relief is low (L) topography is planar (p).

Access roads are constructed very easily in eolian terrain, but the erosion potential is high once the protective vegetation cover has been removed. A high water table may limit excavations in places, and slumping and piping can occur. Driven well points will supply enough water for domestic use in eolian deposits below the water table. The pollution potential is high.

3.5 ORGANIC:

Examples:

$$\frac{\text{pOT}}{\text{Lp-W}} \qquad \frac{\text{pOT(tMG)}}{\text{Lp-M}} \qquad \frac{\text{pOT(sED)}}{\text{Lp-M}} \qquad \frac{\text{spOT}}{\text{Lp-Mh}}$$

Organic terrain (OT) composed primarily of peat (p), with some silt (m) and sand (s), occurs throughout the map-area in isolated, poorly drained (W) depressions within other terrain units. Associated landforms include glaciofluvial outwash sand (sGO), eolian sand (sED), and ground moraine (MG). The largest unit of organic terrain occurs south of Highway 129 in the southeastern part of the area.

Construction is difficult and expensive in organic terrain due to the poor drainage conditions and the low strength, low bearing capacity, high compressibility, and extremely high frost susceptibility of the soil materials. Groundwater in organic deposits is generally of poor quality and unsuitable for drinking. Septic drain tile fields should not be placed in organic terrain.

3.6 ALLUVIAL:

Examples:

$$\frac{\text{sAP}}{\text{Lp-W}} \qquad \frac{\text{sAP(pOT)}}{\text{Lp-M}}$$

Alluvial plains (AP) occur along most river channels, but many are too small to map at the scale of 1:100 000. The alluvial plains along the Nemegosenda and Mattawan Rivers have been mapped and are composed primarily of sand (s). Silt (m) and peat (p) are also common in alluvium. Relief is low (L) and drainage is most often wet (W) with a high water table (h).

Foundation conditions are generally poor in alluvial terrain since materials are fine grained and water-saturated. Structures built on alluvial plains will be subject to flooding and would require suitable protection. Erosion potential and slope instability are high along stream banks. Groundwater potential is good in gravelly materials and poor in fine-grained materials. Alluvium is not suitable for waste disposal because of periodic flooding and the potential for pollution.

4.0 EXAMPLE OF DERIVED MAP: ENGINEERING CAPABILITY

4.1 TYPES OF DERIVED MAPS:

The Data Base Map (OGS Map 5014, accompanying this report) forms a basic framework of resource characteristics that allows development of a wide variety of engineering and planning derivative maps. A derivative map can be defined as a graphic representation of the terrain

in terms of its potential with respect to a specific engineering or planning use, or a number of uses. Derivative maps are needed because many people who have special interests in the map-area do not have the geological or engineering expertise to fully interpret the Data Base Map for their particular application. The objective of presenting a derivative map in this report, therefore, is to demonstrate how an easily understood illustration can be produced from the Data Base Map.

Many different types of derivative maps can be produced. For example, a "Granular Aggregate Probability Map" would classify terrain units into high, moderate, and low rating categories with respect to potential for finding aggregate. The analysis could be taken a step further through preparation of a Sand and Gravel Resources Map (see Roed 1979b). This type of derivative map would incorporate not only the geological conditions of the terrain unit but also important criteria such as access and size of deposit, in order to outline areas which are best suited for aggregate extraction.

Similarly, derivative maps can be developed which rate the terrain units for other important uses, such as groundwater potential, septic system suitability, solid waste disposal, general construction suitability, route assessment, and mineral exploration. It is possible to prepare a derivative map which would outline areas of extremely poor suitability for a specific use such as housing. For example, organic terrain and flood plain units along rivers would be shown as hazard areas with respect to housing.

4.2 ENGINEERING CAPABILITY MAP:

The derived map (OGS Map 5018) included in this report outlines major terrain units in the Chapleau area which are well suited for the following uses: aggregate extraction, transportation route alignment, groundwater supply, solid waste disposal, and septic system installations. Hazard lands are also shown. It is referred to, therefore, as an Engineering Capability Map and is considered to be a general type of derivative map rather than a specific-use type.

4.2.1 Aggregate Extraction:

Esker and kame complexes (Unit 1 on Map 5018) and outwash terrain (Unit 2) are very suitable for aggregate extraction. Twenty-five of the 47 major sand and gravel pits recorded by the Ministry of Transportation and Communication are located in terrain mapped as esker and kame complexes. Twenty-one pits occur in outwash plains and one is located in terrain mapped as ground moraine.

Major eskers and kames which are presently being used for aggregate extraction include (1) a kame complex with associated eskers on Highway 101 west of Chapleau, in Hoey Township, (2) eskers on Highway 101 east of Chapleau, in Gallagher, Borden and Chewett Townships, and (3) the esker in Chapleau and Panet Townships. South of the Sultan Scarp (see Map 5014, accompanying this report), where there appears to be fewer eskers at surface, gravel pits are located in the outwash plains.

The probability of locating aggregate in eskers is high, particularly in the central core or ridge and where steep-sided kettles or pits are well developed. Aggregate probability in kame complexes is also high, but considerable variability in aggregate quality can be expected since the internal composition and structure of kames are much less uniform than in the case of eskers.

Outwash plains possess the largest and most consistent potential for aggregate supply potential. However, much of the outwash in the area is covered by a blanket of fine eolian sand, so that recognition of aggregate potential in the outwash will be more difficult based on cursory examination.

A drilling and sampling program should be undertaken in the outwash terrain south of the Sultan Scarp so that reliable estimates of aggregate quality and quantity can be obtained.

4.2.2 Transportation Route Alignment:

Glaciofluvial plains (Unit 2 on Map 5018) are the most suitable unit for construction of transportation routes, since they offer the best combina-

tion of soil conditions, drainage, topography, and uniformity of conditions for ease of construction. The sand and gravel are not susceptible to frost action, have excellent bearing capacity, and make good base and subgrade for access road and railroad construction. There are fewer drainage courses than in rock terrain, for example, so that the number of stream crossings is minimized. The relatively flat topography eliminates the cut-and-fill operations required to handle excessive grades. Uniformity of good conditions throughout extensive tracts of outwash terrain is also an advantage, as construction techniques can be standardized. The great extent of an outwash plain is in itself a positive factor, since access to most areas can be planned so as to take advantage of the favourable conditions provided by this terrain unit. A problem associated with route alignment in glaciofluvial plains is the necessity of avoiding organic terrain, since bearing capacity in this unit is low and frost susceptibility is high. In some cases of minor route location this has not been a great problem, as a number of access roads pass through organic terrain.

Esker and kame complexes and morainal terrain are also suitable for transportation route alignment. However, steep topography and numerous kettle lakes can be expected in some localities, and where morainal deposits are thin, expensive bedrock excavations may be necessary.

4.2.3 Groundwater Potential:

Groundwater supply potential in the map-area is highest in the eskers and outwash. Permeabilities in the range of 10^{-2} to 10 cm/sec and thicknesses of up to 30 m for eskers and 40 m for outwash increase the probability of tapping a very large supply of water in both of these units. Groundwater potential is also high in kames and hummocky moraine, but less permeable sections of these units may be non-productive on a large scale. Other terrain units except organic terrain would be capable of producing adequate quantities of water for domestic demand.

4.2.4 Solid Waste Disposal:

Morainal terrain (Unit 3 on Map 5018) is suitable for solid waste disposal in this map-area, since till is generally the best material for attenuation of leachate from solid waste disposal sites. Hummocky moraine is the best

landform for a solid waste disposal site, as it offers not only good soil conditions but also the substantial thickness and good drainage conditions necessary for treatment of leachate. Ground moraine has excellent soil and drainage conditions, but the unit may be too thin in some areas for adequate leachate treatment to take place.

Solid waste landfills should not be located in eskers, outwash, and alluvial terrain, as the pollution potential in these units is extremely high.

4.2.5 Septic System Suitability:

Morainal terrain (Unit 3 on Map 5018) is the most suitable unit for septic system installation and operation. Hummocky moraine is the best landform for this purpose, for the same reasons given in Section 4.1.4. Ground moraine is also suitable for septic systems where at least 1.5 m of till overlies bedrock.

4.2.6 Hazard Land:

Organic terrain and alluvial plains (Unit 5 on Map 5018) are generally not suitable for any of the above uses. This can be attributed to poor soil and drainage conditions. Bearing capacity is very low and soils are frost susceptible and often highly compressible. Most organic terrain is wet, has a high water table and is poorly drained. Alluvial plains are subject to flooding, especially during spring thaw and periods of heavy precipitation.

Development to date has avoided hazard lands. However, with greater development pressures in the future, especially along rivers and lakeshores, it is important that hazard lands remain undeveloped.

5.0 REFERENCES:

Boissonneau, A. N.

1965: Surficial Geology, Algoma, Sudbury, Timiskaming and Nipissing, Ontario Department of Lands and Forests, Map S465, scale 1:506 880 or 1 inch to 8 miles. Surficial geology 1962, 1963.

1968: Glacial History of Northeastern Ontario II. The Timiskaming-Algoma Area; Canadian Journal of Earth Sciences, Vol.5, No.1, p.97-109.

Dean, W. G.

1956: Glacial Features of the Hearst-Cochrane Map-Sheet Area, An Aerial Photograph Reconnaissance; The Canadian Geographer, No.8, p.35-45.

Gartner, John F., Mollard, J. D., and Roed, M. A.

in preparation: Ontario Engineering Geology Terrain Study Users' Manual; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 1.

Ontario Land Inventory

1976: Land Classification, Chapleau, 41O, Edition 2 MCE, Series A501; Ontario Centre for Remote Sensing, Ministry of Natural Resources.

Prest, V. K.

1969: Retreat of Wisconsin and Recent Ice in North America; Geological Survey of Canada, Map 1257A, scale 1:5 000 000. Compiled 1969.

1970: Quaternary Geology of Canada; p.675-764 *in* Geology and Economic Minerals of Canada, edited by R. J. W. Douglas, Geological Survey of Canada, Economic Geology Report No.1, 5th edition, 838p.

Prest, V. K., Grant, D. R. and Rampton, V. N.

1967: Glacial Map of Canada; Geological Survey of Canada, Map 1253A, scale 1:5 000 000. Compilation 1964-1966.

Roed, M. A.

1979a: Elk Lake Area (NTS 41P/NE), District of Timiskaming; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 83, 18p. Accompanied by Map 5020, scale 1:100 000.

1979b: New Liskeard Area (NTS 31M/NW), District of Timiskaming; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 84, 28p. Accompanied by Maps 5021 and 5025, scale 1:100 000.

Roed, M. A. and Hallett, D. R.

1979: Wenebegon Lake Area (NTS 41O/SW), District of Algoma and Sudbury; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 86, 15p. Accompanied by Map 5016, scale 1:100 000.

Skinner, R. G.

1969: A Summary of the Quaternary Stratigraphy of Northern Ontario, Canada; unpublished manuscript, University of Washington, Seattle, 12p.

Springer, Janet

1977: Ontario Mineral Potential, Gogama Sheet and part of Ville-Marie Sheet, Districts of Sudbury and Timiskaming; Ontario Geological Survey, Preliminary Map P.1514, Mineral Deposits Series, scale 1:250 000. Compilation 1976, 1977.

Thurston, P. C., Sage, R. P. and Siragusa, G. M.

1976: Chapleau-Foleyet, Algoma, Cochrane, and Sudbury Districts; Ontario Geological Survey, Map 2221, Geological Compilation Series, scale 1:253 440 or 1 inch to 4 miles. Geology and revised compilation 1970, 1970 and 1974.

1977: Geology of the Chapleau Area, Districts of Algoma, Sudbury and Cochrane; Ontario Geological Survey, Report 157, 293p. Accompanied by Maps 2351 and 2352, scale 1:250 000, and Map 2221, scale 1:253 440 (1 inch to 4 miles).

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